



## **Green Zia Tools for Composting Los Alamos National Laboratory Wet Waste**

### **Background**

Aramark Services, Inc., is the food services subcontractor for Los Alamos National Laboratory (the Laboratory), and operates several cafeterias on-site. Each year, the Laboratory's cafeterias generate between 150 and 200 tons of sanitary wet waste, which includes food scraps and food contaminated materials. Wet waste can be composted and then reused for fertilizer, erosion control, or mulch.

As part of its commitment to good environmental stewardship, Aramark teamed with personnel from the Laboratory's Facility Waste Operations-Diversified Facilities Group (FWO-DF) and Johnson Controls Northern New Mexico (JCNNM) to identify composting or other recycling alternatives for the Laboratory's wet waste. FWO-DF has ultimate responsibility for the Laboratory's cafeterias; JCNNM is the facility support subcontractor to the Laboratory and operates the Laboratory's recycling program.

This paper presents the approach used by Aramark, FWO-DF, and JCNNM identify viable recycling options for wet waste. The approach utilizes the *New Mexico Green Zia Systems Analysis Tools* (Green Zia tools), as specified in Function Area 3 (Managerial Accomplishments) of Section B, Part II-1, Appendix F of the DOE/University of California contract (2001). The Green Zia tools employed in this project were generally accomplished according to the New Mexico Green Zia Environmental Excellence Award Program guidance at <http://www.nmenv.state.nm.us>.

### **The Challenge**

Cafeteria wet waste accounts for approximately 10 percent of the Laboratory's sanitary solid waste stream. For the Laboratory to meet DOE's goal of recycling 45 percent of its sanitary solid waste stream, cafeteria wet waste must be reduced or recycled. In addition, the Los Alamos County landfill, where the Laboratory currently disposes of all its sanitary solid waste, is scheduled to close in June 2004. The challenge for this Green Zia team was to evaluate plausible recycling alternatives for wet waste and to develop a reasonable implementation plan that allows the Laboratory to meet DOE's goals while avoiding the costs associated with off-site disposal.

## Green Zia Composting Team

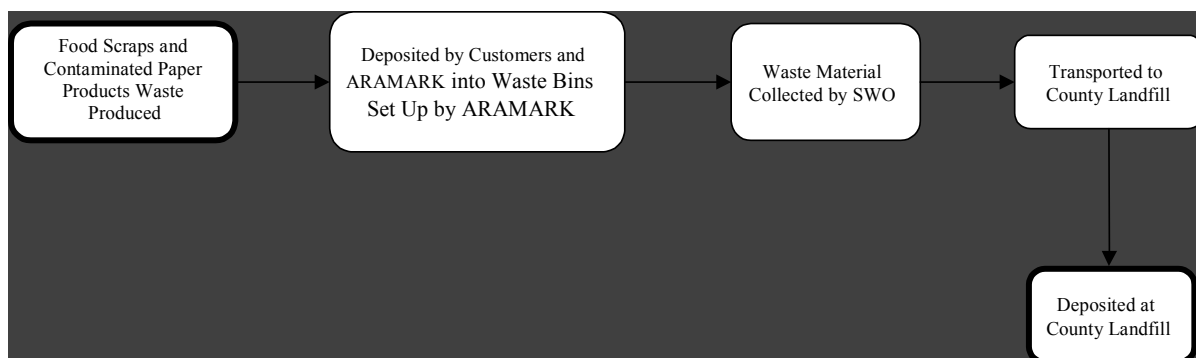
Aramark, FWO-DF, and JCNNM formed a multi-disciplinary team to investigate recycling options, which met on several occasions to complete this project. The following individuals were team members:

- James Dalton, FWO-DF, Building Manager
- Steve McCleary, FWO-DF, Operations Team Leader
- Patricia E Gallagher, E-ESO, Pollution Prevention Program Manager
- Bruce Reed, Aramark Services Inc., Food Services Director
- Camille Bustamante, JCNNM/Eberline Services, Recycling Coordinator
- Mark Haagenstad, JCNNM/Eberline Services, Solid and Liquid Waste Program Coordinator
- Jim Stanton, JCNNM/Eberline Services, P2 Program Coordinator

## Process Characterization

The team prepared a process map describing the current method for managing wet waste from cafeteria operations (Figure 1).

**Figure 1. Detailed Process Map Illustrating Wet Waste Management**



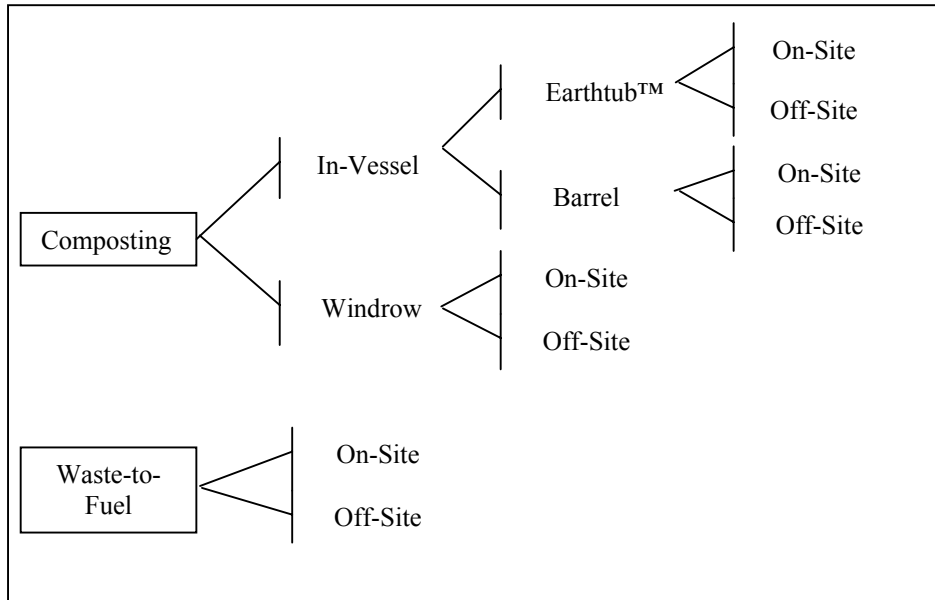
## Statement of Problem

Cafeteria operations at the Laboratory generate 150 to 200 tons of wet waste per year, or about 0.77 tons per day. Currently, that waste is shipped directly to Los Alamos County Landfill at a cost of \$213 per ton. In June 2004, the Los Alamos County Landfill will close, which will require the Laboratory to ship this waste to a regional landfill at an expected cost of \$185 per ton. In addition to the landfill disposal cost, the Laboratory will be required to process all waste intended for a regional landfill through its Material Recycling Facility (MRF) at an expected cost of \$700 per ton. Thus, after the Los Alamos County Landfill closes, the Laboratory expects its overall disposal costs to increase from \$213 per ton to \$885 per ton. Further, DOE is requiring the Laboratory to recycle at least 45 percent of its sanitary solid waste by 2005. In light of these issues, the Laboratory must identify and implement a cost effective wet waste management solution before June 2004.

## Generating Process Alternatives

In response to the problem stated above, the team developed the alternatives shown in Figure 2.

**Figure 2: Recycling Alternatives**



## Selecting an Alternative

### Earthtub™

The team originally convened to examine the plausibility of using Earthtubs™ to compost wet waste at each Laboratory cafeteria location. The basic concept behind Earthtubs™ is that wet waste is placed into a tub, along with bulking agent (wood chips, shredded paper, etc.). An electrical heater and mixer keep the material at optimum composting conditions. The composting material must stay in the tub for several weeks until the compost is ready to use.

Although Earthtub™ technology is certainly viable and effective, the team quickly determined that the tubs were not an appropriate for use at Laboratory cafeterias. As many as 20 Earthtubs™ would be necessary to compost all the wet waste generated at the cafeterias and there was not enough room available at each site to accommodate multiple tubs. In fact, based on current facility configurations and future plans for TA-3 construction, the team believed that there was not enough room for even two Earthtubs™ per site. This is important because the team felt that two tubs would be the minimum that could be placed at any given site so that one tub could receive new waste while the other was composting older material.

After rejecting the idea of Earthtubs™ at each cafeteria, the team also quickly eliminated the thought of using the tubs at a centralized facility. The land area needed to place and effectively operate 20 tubs was comparable to that needed to operate a windrow facility. Since a windrow facility could be sited and operated without the expense of purchasing the tubs, a centralized Earthtub™ facility (either on- or off-site) was clearly not cost effective. Based on this information, the team rejected the Earthtub™ alternative.

### Waste-to-Fuel Conversion Units

Thermotech, Inc., out of Albuquerque, New Mexico, operates a research and development (R&D) facility that converts any combustible material into ethanol for use as an alternative fuel. The amount of ethanol produced depends on the feedstock, but paper, plastic, rubber, wood, and wet waste can all be processed through the unit. The unit requires segregated feedstock, so all waste must be processed by the Laboratory's Material Recycling Facility (MRF) before being transported to the treatment facility.

The team realized the enormous potential of processing the Laboratory's waste through this type of facility. This unit would significantly reduce carbon dioxide emissions, ease demand on fossil fuels, and save landfill space. While the team feels that the Laboratory should support this type of innovation, members had significant concerns over this technology's practical impact on the current problem. Specifically, Thermotech does not yet have a commercial plant and the team felt that one would not be available for three to five years, at a minimum. This prevents the Laboratory from being able to rely on waste conversion technology before the Los Alamos County Landfill closes and makes it doubtful that the technology would contribute to meeting DOE's 2005 sanitary waste goals. Additionally, the team felt that this technology was cost prohibitive because of the cost of purchasing, siting, and permitting the unit, as well as the increased cost of processing the waste (see Table 1).

**Table 1: Waste-to-Fuel Project Costs**

| <b>Activity</b>   | <b>Cost</b>          |
|---|----------------------|
| Directly landfill wet waste                                       | \$213 per ton        |
| Process wet waste through the Laboratory's MRF                    | \$700 per ton        |
| Purchase Thermotech, Inc., waste conversion unit                  | \$300,000            |
| Site waste conversion unit  | \$250,000            |
| Permitting  | \$200,000            |
| <b>Total Project Cost</b>   | <b>\$750,000</b>     |
| <b>Increase in Operational Costs (Direct Landfilling vs. MRF)</b> | <b>\$487 per ton</b> |

Based on this information, the team rejected the waste-to-fuel conversion alternative as a short-term solution to wet waste management. However, the team remains open to the R&D aspects of this technology and recommends further Laboratory involvement in it.

### Composting

As stated previously, the team originally convened to examine wet waste composting using Earthtub™ technology. However, as Figure 2 indicates, windrow and in-vessel barrel composting are also viable alternatives. Therefore, the team examined these possibilities as well.

The team feels that the only reasonable on-site composting alternative is in-vessel barrel composting. Material processed in barrel composting is ready for land application within three days. Units have minimal space requirements and can be employed at central or satellite locations throughout the Laboratory.

Off-site windrow facilities exist already and are available for immediate implementation. Off-site in-vessel barrel facilities will exist in the near future. Both off-site options require that the Laboratory use a central collection area and ship wet waste to the facilities. Transportation costs prohibit daily trips to any off-site facility. In order to keep the stench of fermenting wet waste from becoming a nuisance and to keep from attracting vermin or insects, the wet waste will need

to be placed between layers of high-carbon material (e.g., shredded paper, wood chips, saw dust, etc.). This will require the Laboratory (or a selected vendor) to closely coordinate wet waste collection and layering operations.

Table 2 shows some estimated costs of off-site windrow and in-vessel barrel composting. Table 3 suggests that the cost of off-site composting would be competitive with that of direct or MRF-mediated disposal. While the in-vessel barrel option has significantly reduced transportation costs, the Laboratory may need to assist in purchasing a barrel composting unit. Still, establishing the in-vessel barrel option at the Nambé Recycling Facility (NRF) would assist the Laboratory in meeting its economic development goals. NRF personnel are interested in this technology and have expressed that if the Laboratory purchased the equipment for the NRF, NRF personnel would process the Laboratory's wet waste at no cost until the value of the unit is met based on a cost per ton formula.

**Table 2: Estimated Off-Site Composting Costs**

| Activity   | Windrow Composting in Albuquerque, NM |                          | In-Vessel Barrel Composting in Nambé, NM |                          |
|--|---------------------------------------|--------------------------|--|--------------------------|
|  | \$ Per ton                            | \$ Per year <sup>1</sup> | \$ Per ton                               | \$ Per year <sup>1</sup> |
| Tipping Fee  | \$4                                   | \$3840                   | \$14.50 <sup>2</sup>                     | \$13,920                 |
| Transportation   | \$81                                  | \$77,760                 | \$13.50                                  | \$12,960                 |
| <b>Total</b>   | <b>\$85</b>                           | <b>\$81,600</b>          | <b>\$28.00</b>                           | <b>\$26,880</b>          |
| 1. Assumes 32 trips per year with 30 tons per trip of combined wet waste and carbon bulking agent.<br>2. This tipping fee has not been determined. The number shown here is based on analogy to other wastes processed at Nambé. |                                       |                          |  |                          |

**Table 3: Direct and MRF Waste Disposal Costs**

| Activity                                       | \$ Per ton | \$ Per year      |
|--|------------|------------------|
| Direct wet waste disposal <sup>1</sup>         | \$213      | \$42,600         |
| Direct carbon waste disposal <sup>2</sup>      | \$213      | \$161,880        |
| <b>Total Direct</b>                            |            | <b>\$204,480</b> |
| Wet waste disposal through MRF <sup>1</sup>    | \$700      | \$140,000        |
| Carbon waste disposal through MRF <sup>2</sup> | \$700      | \$532,000        |
| <b>Total Through MRF</b>                       |            | <b>\$672,000</b> |
| 1. 200 tons per year<br>2. 760 tons per year   |            |                  |

## Recommendations for Implementation

The team recommends taking immediate action on composting, while exploring the long-term, larger picture issues represented by waste-to-fuel technology. Regarding composting, the first items to be addressed include determining the feasibility and cost of in-vessel barrel composting at each cafeteria and/or an on-site central facility. Of equal importance is determining the costs and logistics of a centralized collection area. Resolution of these issues will indicate which site (on or off) is in the Laboratory's best interest to implement. If, as the team currently believes, off-site composting is in the Laboratory's best interest, then the Laboratory should move swiftly to implement a composting program at Soilutions, Inc., in Albuquerque, NM, until the

composting facility at Nambé Recycling Facility is operational. Once Nambé is accepting waste, the Laboratory would avoid additional costs and increase economic development by switching to Nambé. Finally, team believes that the Laboratory should further investigate waste-to-fuel technology and, if appropriate, obtain long-term funding for it.

In light of these recommendations, the team prepared an action plan to implement composting. Full implementation will be coordinated through the project team, which will meet quarterly to assess progress, identify and implement lessons learned, and quantify the action plan's specified metrics. The ultimate goal of implementing this action plan would be to determine the best course of action for the Laboratory by January 15, 2002, and to begin composting the Laboratory's wet waste by September 30, 2002.

### **Action Plan**

**Deadline: September 30, 2002**

#### **Goal #1: Determine the feasibility and cost of in-vessel barrel composting at each cafeteria and/or an on-site central facility**

Objectives:

- Establish site requirements for composting at each cafeteria;
- Determine the labor and equipment costs for composting at each cafeteria;
- Establish site requirements for composting at a central facility;
- Determine the labor, equipment, and transportation costs for composting at a central facility; and
- Determine which option (composting at each cafeteria or at a central facility) is in the Laboratory's best interest.

#### **Goal #2: Determine the costs and logistics of operating a centralized collection area for off-site composting**

Objectives:

- Establish site requirements for a central collection area;
- Determine the labor, equipment, and transportation costs for operating a central collection area;
- Perform a more detailed cost analysis on the best option from Goal #1 and off-site composting; and
- Determine whether on-site or off-site composting is in the Laboratory's best interest.

#### **Goal #3: Implement composting**

Objectives:

- Segregate wet waste from other wastes to eliminate need for processing at the MRF (to be completed regardless of implementation status of other goals);
- Identify organizations responsible for implementation; and
- Prepare site(s), procure equipment, develop procedures, develop and give training, prepare safety documentation, and begin operations.